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Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1989 and predictions for 1990

F. J. Emond and H. F. Cerezke

Information Report NOR-X-313
Northwest Region

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FOREST INSECT AND DISEASE CONDITIONS IN ALBERTA, SASKATCHEWAN, MANITOBA, AND THE NORTHWEST TERRITORIES IN 1989 AND PREDICTIONS FOR 1990

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ABSTRACT

Forest pest conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories during 1989 are summarized and some predictions of infestation status are given for 1990. Eleven major pests are discussed, and additional noteworthy insects, diseases, and tree damage agents are reported in a table. Results of surveys for acid rain symptoms and pests and damage incidence in nurseries and plantations are also reported.

RESUME

Les auteurs présentent un résumé de la situation relative aux insectes et aux maladies observés dans les forêts de l'Alberta, de la Saskatchewan, du Manitoba et des Territoires du Nord-Ouest en 1989 en plus de formules certaines prévisions pour 1990. Onze revageurs important sont examinés, et les données sur d'autres insectes, maladies et agents de destruction des arbres dignes de mention sont présentées dans un tableau. Des détails sont également donnés sur les résultats de relevés portant sur les symptômes reliés aux pluies acides et sur les agents nuisibles et l'incidence des dommages dans les pépinières et les plantations.

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NOTE

The exclusion of certain manufactured products does not necessarily imply disapproval nor does the mention of other products necessarily imply endorsement by Forestry Canada.

INTRODUCTION

The Forest Insect and Disease Survey (FIDS) unit at the Northern Forestry Centre (NoFC) of Forestry Canada annually conducts general surveys to detect and monitor important forest insects, diseases and other tree damaging agents in Forestry Canada's Northwest Region (Manitoba, Saskatchewan, Alberta, Northwest Territories, and the Rocky Mountain national parks). The surveys include aerial mapping of pest infestations and various ground plot examinations to verify pest identifications, damage intensity, and host records. Much of this work is conducted in cooperation with a number of federal, provincial, municipal, and industrial agencies:

Agriculture Canada
Alberta Environment
Alberta Agriculture
Alberta Forestry, Lands and Wildlife
Northwest Territories Renewable Resources
Manitoba Agriculture
Manitoba Natural Resources
Canadian Parks Service
Provincial parks
Saskatchewan Agriculture
Saskatchewan Parks and Renewable Resources
Forest industries
Urban parks departments

In addition, collections of insect and disease species made during the surveys are maintained at NoFC and provide continuity of historical records within the permanent insect collection and herbarium, as well as contribute information in support of plant quarantine and forest research projects. The results of these regional pest surveys contribute to an annual review of national forest pest conditions. Other special surveys are conducted as part of a national program of acid rain monitoring, under the umbrella of ARNEWS (Acid Rain National Early Warning System).

This regional report summarizes the status of major forest insects and diseases and other tree damage agents within the three prairie provinces and Northwest Territories in 1989 and forecasts expected trends of some pests and their damage in 1990. Special surveys are reported on, and other noteworthy insects, diseases, and other tree damage agents are summarized in tabular form. Information for this report has been contributed largely from field observations, special collections, and records collected from April to late October by five FIDS ranger staff assigned to the following jurisdictional areas:

Manitoba: Mike Grandmaison
Saskatchewan: Gary Still
Northern Alberta and Northwest Territories: Craig Tidsbury
Central and southern Alberta: Howie Gates
National and provincial parks, urban areas and other selected high-priority sites: Jim Emond

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David Langor, Entomologist; insect collection maintenance and diagnostics
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Bruce Pope, Forestry Assistant in FRDA; mapping and data base
Jan Volney, Project Leader for FIDS and Entomologist
Daryl Williams, Entomology Technician; collection and diagnostics

The pests reported here are arranged more or less according to national and regional importance. Comments on other noteworthy insects, diseases, and other tree-damaging agents appear at the end of the report (Appendix I).

SPRUCE BUDWORM *Choristoneura fumiferana* (Clem.)

In the Northwest Region spruce budworm infestations increased in size and intensity in several areas in 1989 (Fig. 1), and several new infestations were identified. The infestations covered an overall area of 277 110 ha compared to 137 821 ha reported in 1988 (Table 1). Notable increases were evident in most of the previously reported infestations. Three new infestations were reported in west-central Saskatchewan and one in the Peace River Forest in Alberta. Several aerial spray programs were undertaken for budworm control using the biological insecticide *Bacillus thuringiensis* (Bt). The areas treated were high-value sites in two provincial parks in central Alberta, a white spruce forest in northwestern Alberta, and two provincial parks and a commercial forest in Manitoba.

Figure 1. Areas of moderate-to-severe defoliation by the spruce budworm in 1989.

Table 1. Summary of spruce budworm defoliation sketch-mapped from aerial and ground surveys in 1988 and 1989

Location	Area of defoliation (ha)		
	1988	1989	Change
Alberta	61 050	85 850	24 800
Saskatchewan	31 600	34 650	3 050
Manitoba	30 821	58 016	27 195
Northwest Territories	14 350	98 600	84 250
Total	137 821	277 110	139 295

In central **Alberta,** spruce budworm infestations caused light-to-moderate defoliation in white spruce stands in Big Knife Provincial Park (100 ha), near Castor (200 ha), near Millet (50 ha), along the Battle River valley between Camrose and Donalda (250 ha), and in the northeast section of Red Lodge Provincial Park (25 ha). Light defoliation was evident in some native spruce stands along the North Saskatchewan River between Edmonton and Devon.

In the Footner Lake Forest in northern Alberta, a notable increase in infestation area was reported in white spruce stands along the Chinchaga River and extending eastward. A total of 78 995 ha of light-to-severe defoliation was mapped in this area compared to 61 050 ha reported in 1988. In the Grande Prairie Forest about 1000 ha of moderate-to-severe defoliation occurred for about the fifth consecutive year in white spruce stands along the Peace River north of Eaglesham. In this area, the Alberta Forest Service conducted an experimental aerial spray trial over the 1000 ha with Bt. This experiment, the first of its kind attempted by the Alberta Forest Service, was to provide reduction of budworm defoliation and larval populations and to provide training experience in aerial control technology. The post-spray results indicated some foliage protection was achieved, but it was lower than expected due to the late date of application (June 17).

In the Lac La Biche Forest, light-to-moderate defoliation was reported over an area of 4230 ha, an increase from 200 ha reported in 1988.

In the Peace River Forest a new infestation was reported in the Hawk Hills over 1000 ha of white spruce forest.

In **Saskatchewan,** spruce budworm infestations in the Porcupine Hills in the east-central part of the province remained at much the same level and extent as in 1988. Moderate-to-severe defoliation was evident in spruce stands near the Eldredge and McBride lakes, Tall Pines, Mann Lake, Usherville, and Big Valley. In the Red Earth outbreak, moderate-to-severe defoliation extended northwest to the Carrot River and south of Highway 55 into the Pasquia Hills. A portion of this outbreak in the area north of Highway 55 was logged out in 1989, with the exception of that part of the outbreak occurring within the Red Earth Indian Reserve. Timber harvesting is currently in progress in most of the remaining infestations.

Three new infestations were reported in white spruce stands in the west-central part of the province. Patches of light, moderate, and severe defoliation, respectively, were reported in the Taggart Creek area south of Sled Lake, near Pancake and Delaronde lakes, and north of Paradise Hill along the Monnery River.

The total area of spruce budworm defoliation in Saskatchewan in 1989 was 34 650 ha, slightly higher than the 31 600 ha recorded in 1988 (Table 1).

In **Manitoba,** spruce budworm infestation areas increased significantly in 1989 in most of the outbreak areas reported in 1988, affecting a total of 58 016 ha of white spruce-balsam fir forests (Table 1). Moderate-to-severe defoliation was evident in Whiteshell Provincial Park and in the Lake Wanipigow area. Light defoliation was observed in several spruce stands throughout the Interlake Forest Section, where close to 9600 ha were defoliated, and also in the Pineland (7252 ha) and Nelson (1295 ha) forest sec-

tions (Fig. 1). Many of these were either new or expansions of infestations reported in 1988.

An aerial spray program was implemented by Manitoba Natural Resources with Bt over an area of nearly 4000 ha of commercial forest (Abitibi-Price F.M.A.) and about 1000 ha of high-use recreational forests (Whiteshell and Nopiming provincial parks). Both foliage protection and larval reduction were achieved.

In the **Northwest Territories,** the total area of spruce budworm infestations in white spruce stands markedly increased in 1989 to 98 600 ha as compared to 14 350 ha reported in 1988 (Table 1). The largest infestation extends along the Liard River from the Fisherman Lake—B.C. border area north to Fort Simpson, within which defoliation increased in both area and intensity in 1989. The most notable areas where moderate-to-severe defoliation occurred and increased were near the mouth of the Blackstone River, in the Petitot River area, and along Highway 7. Similar defoliation intensity was also evident along the Mackenzie River northwest of Fort Simpson through to the Martin River. Moderate defoliation occurred near the confluence of the North Nahanni and Mackenzie rivers and between Jean-Marie Creek and Highway 1.

In the Slave River outbreak areas, a general increase in intensity of defoliation was evident, but the overall size of area remained similar to that affected in 1988. Moderate-to-severe defoliation was present in spruce stands 10 km downstream from the junction of the Salt and Slave rivers, near Hook Lake, and in the Long Island area. Elsewhere, small pockets of light-to-severe defoliation were reported along the Slave River between Landry Creek and Pointe Emuveuse.

Table 2 presents the results of the 1989 egg-mass density and defoliation surveys, moth captures in pheromone traps in 1989, and predicted defoliation levels expected to occur in 1990 for Alberta, Saskatchewan, and Manitoba. In Manitoba, where the same sampling sites have been maintained since 1985, egg-mass densities were generally higher in 1989 than in 1988. These higher densities were paralleled by higher moth catches in pheromone traps at several sampling sites, and together they indicate rising populations. Figure 2 summarizes the spruce budworm moth capture results in pheromone traps from 1985 to 1989 in Manitoba and shows the general trends in four broad regions of the province. The trends show a similarity of pattern for all four regions. Severe defoliation is forecast to occur again in Whiteshell Provincial Park and in Wanipigow, while moderate defoliation may occur in Spruce Woods and Northwest Angle provincial forests.

Egg-mass density surveys conducted by Alberta Forest Service staff in three outbreak areas in Alberta (Chinchaga River, Hawk Hills, and near Eaglesham) all indicate moderate-to-severe defoliation will likely occur in these areas again in 1990.

FOREST TENT CATERPILLAR *Malacosoma disstria* Hbn.

The forest tent caterpillar continued to be one of the major defoliators of trembling aspen in the Northwest Region in 1989. In Manitoba, a marked increase was reported in most of the previously reported infestation areas, as had been predicted last year (Fig. 3). No aspen defoliation was reported in the Northwest Territories. The total estimated area of aspen forests defoliated within the region was 2 295 585 ha as compared to 3 750 876 ha in 1988 (Table 3).

In **Alberta,** the estimated area of aspen forests moderately-to-severely defoliated in 1989 mainly by forest tent caterpillar was 1 179 800 ha, compared to 2 766 000 ha in 1988 (Table 3). This is a significant decrease in areas severely defoliated. Other areas outside of those severely defoliated (Fig. 3) had scattered patches of light-to-severe defoliation, indicating a declining trend in the overall outbreak. The main infestation continued in the aspen parkland and agricultural zone in central Alberta, with considerable extension into forested areas between Edmonton and Edson, from Whitecourt to Fox Creek, between Lesser Slave Lake and Lac la Biche, and into the northern Grande Prairie Forest District. Within the general outbreak area (Fig. 3) there was a notable decline centering on Edmonton in areas severely defoliated, compared to last year; infestations were in scattered patches with light-to-severe defoliation. Moderate-to-severe defoliation of mixed aspen forests was extensive in the Grande Prairie-Peace River area in northwestern Alberta. Light-to-moderate defoliation was also present in the area north of Waterton Lakes National Park through to Twin Butte and near Mountain View. The infestation in Waterton Lakes National Park collapsed in 1989.

Aerial and ground spray control programs against the forest tent caterpillar, using mainly Bt, were

Table 2. Results of surveys for spruce budworm defoliation, egg-mass densities, and moth captures in pheromone traps in 1989, and predicted defoliation levels in 1990

Location	Defoliation (%)	Avg. no. egg masses per $10m^2$ of foliage	Avg. no. moths per trap	Predicted defoliation for 1990[a]
Alberta				
Eaglesham	41[b]	170[b]	450+	Moderate-severe
Musreau Lake	-[c]	-[c]	6	-[c]
Debolt	-	-	31	-
Waskahegan River	-	-	70	-
Wabasca Road	0	0	3	Nil
Hawk Hills	49[b]	235[b]	211	Moderate-severe
High Level	-	-	16	-
Chinchaga River	52[b]	310[b]	-	Moderate-severe
Bovine Creek	22[b]	48[b]	-	Light-moderate
Saskatchewan				
Cowan Lake	0	0	16	Nil
Candle Lake	0	0	6	Nil
Manitoba				
Birds Hill Provincial Park	16	12 (8)[d]	328	Light
Spruce Woods Provincial Forest	13	55 (12)	559	Moderate
Red Deer River	1	0 (0)	52	Nil
Duck Mountain Provincial Park	3	0 (0)	8	Nil
Riding Mountain National Park	2	0 (0)	14	Nil
Northwest Angle Provincial Forest	9	25 (16)	56	Light-moderate
Whiteshell Provincial Park	32	349 (346)	774	Severe
Wanipigow	34	268 (201)	659	Severe
Hecla Island Provincial Park	9	22 (8)	84	Light
Lac Ste. George	2	8 (24)	9	Light
Rocky Lake	3	0 (0)	41	Nil
Simonhouse	3	0 (0)	22	Nil
Pisew Falls	1	4 (0)	16	Light

[a] Based on egg-mass densities where light = <25% defoliation (1-15 egg masses), moderate = 26-50% defoliation (50-100 egg masses), and severe = >50% defoliation (200+ egg masses).
[b] Data collected by Alberta Forest Service.
[c] No data collected.
[d] Values in brackets are for 1988.

undertaken in several counties and provincial parks in central Alberta to reduce foliage loss and the nuisance aspect of the caterpillars.

In **Saskatchewan,** although a decline in forest tent caterpillar population levels and defoliated areas occurred in some parts of the province in 1989, the total area of aspen defoliated (790 740 ha) remained similar to that reported in 1988 (932 040 ha). The main infestations continued in the agricultural zone, although some extensions occurred into the forested zone (Fig. 3). In the main outbreak area in west-central Saskatchewan, moderate-to-severe defoliation was evident in Meadow Lake Provincial Park, south along the Alberta border to Manitou Lake, and eastward to Ruddell, Blaine Lake, Big River, Prince Albert, and Doré Lake. In the east-central part of the province, small, scattered infestations of moderate-to-severe defoliation were detected in the Thunder Hills, Smeaton, Nipawin, and Tobin Lake areas. Similar defoliation was present along the Carrot River west of the Manitoba border and in

Duck Mountain Provincial Park. Much of the defoliation in the latter area was contributed by the large aspen tortrix, *Choristoneura conflictana* (Wlk.).

In **Manitoba,** a marked increase in total area of trembling aspen defoliation was reported in 1989. A total of 325 045 ha of aspen forests was affected compared to 52 836 ha in 1988 (Table 3; Fig. 3). Infestations increased in most forest sections where they were reported last year, with additional expansion into new areas. Most of the defoliated stands occurred in the north-central and western parts of the province where moderate-to-severe defoliation was reported in the following forest sections: Nelson River, Mountain, Highrock, Interlake, and Saskatchewan River. Smaller pockets of similar defoliation were evident in the Hayes River, Lake Winnipeg East, Aspen Parkland, and Pineland forest sections. Much

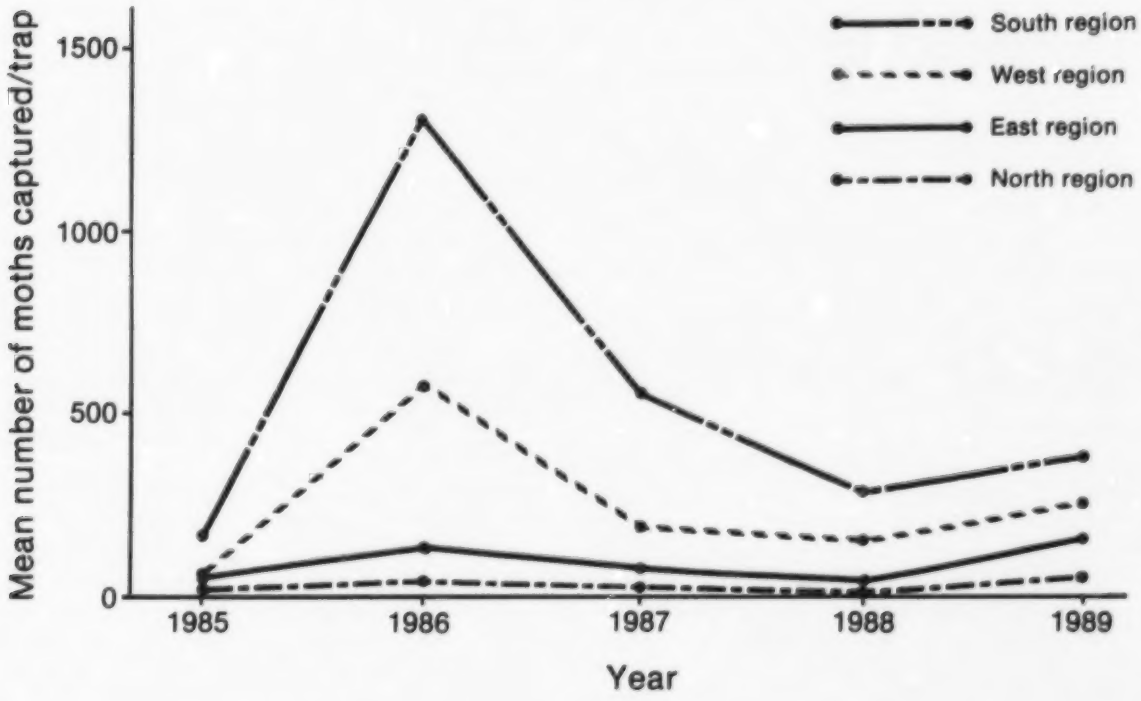

Figure 2. Trends in male spruce budworm moth captured in pheromone-baited Multi-Pher traps from 1985 to 1989, summarized by forest region in Manitoba.

Figure 3. Areas of moderate-to-severe defoliation, caused mainly by the forest tent caterpillar in 1989.

Table 3. Summary of moderate-to-severe defoliation of trembling aspen by the forest tent caterpillar in 1988-89

Province	Area of defoliation 1988 (ha)	Area of defoliation 1989 (ha)
Alberta	2 766 000	1 179 800
Saskatchewan	932 040	790 740
Manitoba	52 836	325 045
Total	3 750 876	2 295 585

of the aspen defoliation in west-central Manitoba (an estimated 18 650 ha) was caused by the large aspen tortrix, especially in Riding Mountain National Park and Duck Mountain Provincial Park.

Egg band surveys were carried out in the three prairie provinces in the fall of 1989 to predict defoliation levels in 1990. The results (Fig. 4) indicate some declines in population levels, especially in central Alberta, west-central Saskatchewan, and much of the northern range of the outbreak area in Manitoba.

LARGE ASPEN TORTRIX
Choristoneura conflictana (Wlk.)

In **Alberta,** the large aspen tortrix was present in trembling aspen stands in many areas of the province in 1989 and caused light-to-moderate defoliation between Calgary, Turner Valley, and Millarville, along Highway 22 between Lundbreck and High River, near Bragg Creek and Cremona, and in some parts of the Cypress Hills. Low populations were detected at a few other scattered locations. Although the large aspen tortrix was generally present throughout the forest tent caterpillar outbreak area, it was not the primary defoliator.

In **Saskatchewan,** the large aspen tortrix contributed significant defoliation of trembling aspen in many areas where the forest tent caterpillar occurred, especially in west-central Saskatchewan and in Duck Mountain Provincial Park. Elsewhere, low populations were observed in most aspen stands examined.

In **Manitoba,** large aspen tortrix infestations increased in 1989, causing light, moderate, and severe defoliation patches of about 18 650 ha in Duck Mountain Provincial Park and Riding Mountain National Park. Low populations of the tortrix were present in most other aspen areas inspected.

BRUCE SPANWORM
Operophtera bruceata (Hulst)

The bruce spanworm caused significant defoliation of trembling aspen forests in many areas of southern and central Alberta. Moderate-to-severe defoliation occurred in the Bragg Creek area, at several scattered locations along Highway 22 between Turner Valley and Lundbreck, in the Obed area east of Hinton, north of Edson, near Marlboro, and along the Trunk Road south of Hinton. Light and moderate defoliated patches were observed in aspen stands north of Cochrane, near Sundre and Didsbury, and near Alix, Stettler, and Fabyan.

LEAF BEETLES
Aspen leaf beetle
Chrysomela crotchi
Willow-and-poplar leaf beetle
Chrysomela falsa
Gray willow leaf beetle
Tricholochmaea decora (Say)

Damage to aspen stands, characterized by moderate-to-severe skeletonizing of leaves, by the aspen leaf beetle, *C. crotchi,* was common in southwestern and central Alberta and central Saskatchewan in 1989. In **Alberta,** the damage was most extensive along Highway 22 between Lundbreck and Black Diamond, north of Bragg Creek through to Water Valley, Sundre, and Didsbury, along Highway 21 between Mirror and New Norway, and at scattered locations between Camrose and Wandering River. Similar defoliation damage was also evident in patches throughout aspen forests in the northwestern part of the province. Light damage was reported between Wandering River and Fort McMurray.

The willow-and-poplar leaf beetle, *C. falsa,* was responsible for leaf skeletonizing of both willow and balsam poplar in Yoho, Banff, and Jasper national parks. Light-to-moderate leaf injury was evident in Yoho National Park from the west gate to Field and continued along Highway 1 to the junction of Highways 1 and 93 in Banff National Park. From this point, damage continued north along Highway 93 to Saskatchewan Crossing and the Weeping Wall. Light damage was noted in Jasper National Park from the Athabasca Falls area to the town of Jasper and

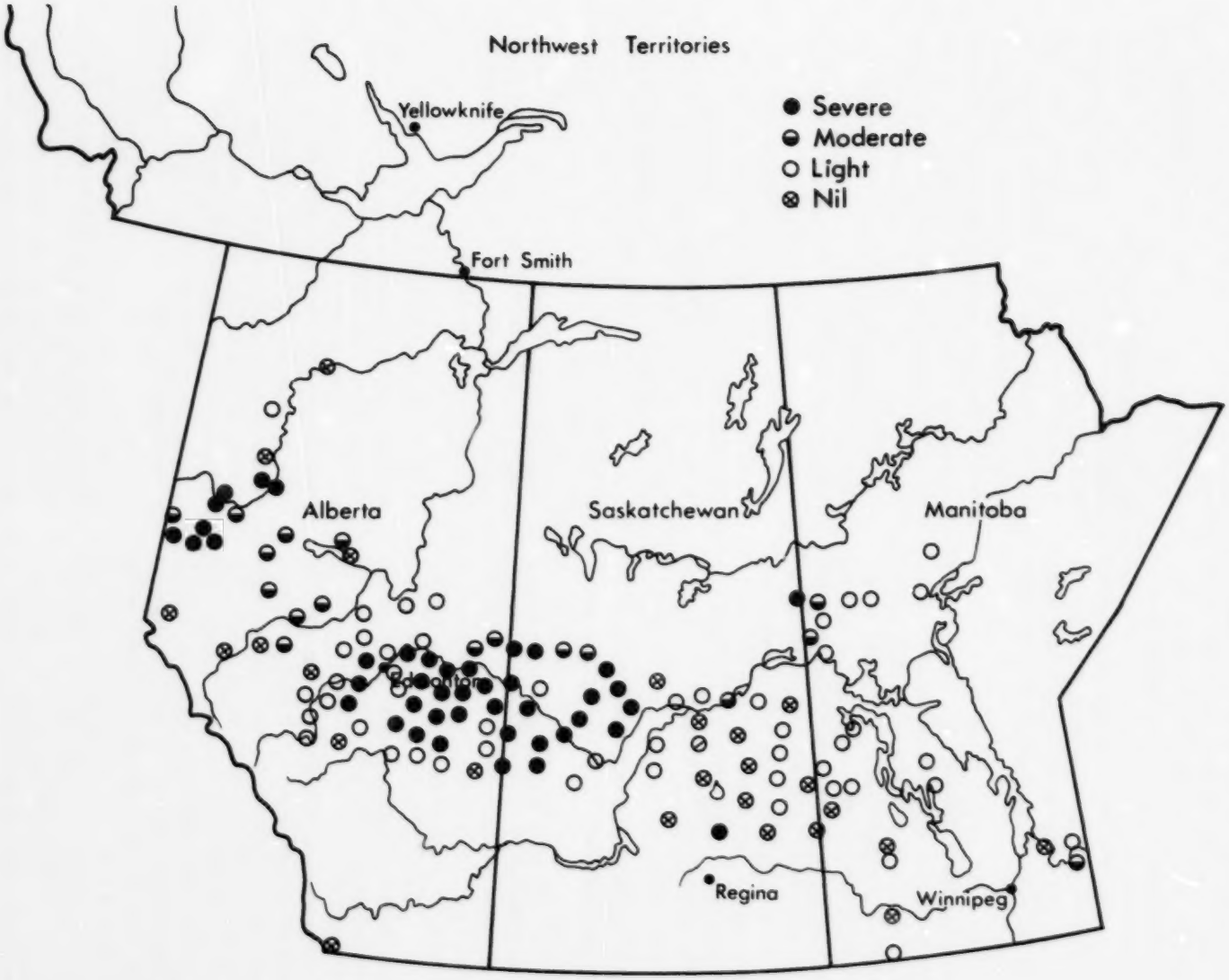

Figure 4. Predicted 1990 defoliation of aspen by the forest tent caterpillar, based on egg-band surveys.

continued along Highway 16 to the junction at Pocahontas.

In **Saskatchewan,** moderate-to-severe leaf skeletonizing of aspen foliage by *C. crotchi* was widespread in the west-central part of the province, especially in the Maidstone-St.Walburg-Turtleford area.

In the **Northwest Territories,** scattered pockets of light damage by *C. falsa* were reported in the following general areas: Wood Buffalo National Park, Fort Smith, Trout River, Kakisa Lake, and Fort Providence.

The gray willow leaf beetle, *T. decora* (Say), caused considerable leaf skeletonizing of the foliage of willow species in several areas in west-central **Alberta:** west of Rocky Mountain House, along Highway 16 between Evansburg and Jasper, at several locations along Highway 43 between Gunn and Valleyview, north of Valleyview to Guy, and in the Peace River and Manning areas. In **Saskatchewan,** scattered pockets of moderate-to-severe skeletonizing of willow species were reported throughout the east-central part of the province.

MOUNTAIN PINE BEETLE *Dendroctonus ponderosae* Hopk.

Aerial and ground surveys conducted in **Jasper National Park** in 1989 revealed no evidence of dispersal of mountain pine beetle (MPB) in the park. Infestations have been reported west of the park, in Mt. Robson Provincial Park, for the past several years, but the risks of population buildup and eastward dispersal of beetles have been minimized by annual monitoring and sanitation control treatments applied in the area between Jasper National Park and Valemount, B.C. The discovery of over 174 1989-attacked lodgepole pine in Mt. Robson Provincial Park, however, indicates a continued potential for subsequent population buildup and spread. The British Columbia Ministry of Forests plans to carry out sanitational tree removal in the winter of 1989. In addition, ground surveys for MPB will be conducted in Jasper National Park in 1990, particularly in an area a few kilometres north of the town of Jasper where a large number of mature lodgepole pine blew over on January 31, 1989.

No surveys were conducted in **Banff National Park;** no beetle-killed trees had been observed in 1988. In **Yoho National Park,** about 15 scattered trees, presumably killed by MPB in 1988, were mapped south of Emerald Lake (Fig. 5). A patch of about 30 presumably MPB-killed trees was also observed near the south end of the park. Other scattered single dead trees occurred along the lower slope of Mt. King and are believed to have died from porcupine (*Erethizon dorsatum myops* Merriam.) girdling.

In **Kootenay National Park,** aerial surveys were conducted in cooperation with Canadian Parks Service and the Pacific Forestry Centre. No new areas of infestation were mapped outside of those recorded in 1988. Within several of the larger infestations, however, such as on Daer and Harkin mountains and an area adjacent to Kimpton Creek, the distribution of dead and dying trees appeared to be more scattered than last year (Fig. 5), thus making tree mortality estimation more difficult. The largest infestation extends between Daer Creek and Pitts Creek and has expanded upslope 300-500 m. Numerous smaller infestations occurred along Pitts Creek and adjacent to Settlers Road near the south end of the park. Infestations near the west end of the park occurred mostly south of Highway 93 near Radium Hot Springs and extend 3-4 km east, especially opposite John McKay Creek and up Kimpton Creek valley. The total number of trees recently killed by MPB within the park is probably similar to or slightly higher than that reported last year (an estimated 3800 trees in 1988).

In **Waterton Lakes National Park,** an estimated 20-30 scattered recently killed lodgepole pine, presumably due to MPB, were observed adjacent to Cameron Lake road and Blakiston Creek.

In southwestern **Alberta,** at least 600 or more recent MPB-killed lodgepole pine in over 400 sites were mapped by the Alberta Forest Service. These occurred either singly or in small groups of 2-10 trees and were scattered throughout the Porcupine Hills, south to Waterton Lakes National Park. The number of infested trees mapped this year reflects an increase over the last 3 years, likely due in part to immigration of beetles from expanded infestations in adjacent southeastern British Columbia (i.e., Fernie-Sparwood area).

Semiochemical tree baits were deployed by the Alberta Forest Service at 13 locations in the southern Bow-Crow Forest and at 12 locations in Kananaskis Country east of Banff National Park. The baits have been used annually since 1983 as part of a detection and monitoring program. Attacks occurred at 11 of the 13 baiting sites in the southern Bow-Crow Forest and at 9 of the 12 baiting sites in Kananaskis Country.

Figure 5. Areas of mountain pine beetle infestations in the Rocky Mountain national parks and southwestern Alberta in 1989.

Most of the attacks, however, were "pitched out" or unsuccessful and did not necessitate tree removal by sanitation cuttings.

Semiochemical baits deployed in the Cypress Hills in southwestern Saskatchewan and adjacent Alberta indicated a continued declining trend in MPB populations. Of the 200 trees baited in each provincial portion of the Cypress Hills, only 9 attacks were recorded on 7 trees on the Alberta side and one attack on the Saskatchewan side. About 180 recently killed lodgepole pine were detected during aerial and ground surveys in Saskatchewan, and most occurred around the perimeters of recent patch cuttings. No MPB were found associated with the large number of these dead trees that were sampled, but associated populations of the pine engraver *(Ips pini* (Say)) were common.

As a result of a long-term forest harvesting plan recently initiated in the Saskatchewan portion of the Cypress Hills, 22 patch cuttings covering a total area of 250 ha have now been completed. This program was instituted with the main objective of gradually removing the old mature even-aged lodgepole pine stands that are now declining and replacing them with a progression of younger age classes widely distributed and in relatively small areas.

LARCH SAWFLY *Pristiphora erichsonii* (Htg.)

In the **Northwest Territories,** the larch sawfly caused moderate-to-severe defoliation in stands of eastern larch in the Fort Smith area, at several locations along Highway 1 between Enterprise and Kakisa Lake, and extending to the Trout River, where defoliation increased. Similar defoliation occurred throughout the Fort Simpson area, along the Mackenzie River to the North Nahanni River, and south along the Liard River to Rabbit Creek. From this point southward to the B.C. border, small pockets of light defoliation occurred in most larch stands checked.

In **Alberta,** low populations of the sawfly caused light defoliation in eastern larch stands west of Rocky Mountain House, between Gainford and Wabamum, near Obed, and west of Fox Creek. Light injury was also noted on Siberian larch plantings in Edmonton and Red Deer and in shelterbelts near Blackfalds and Vermilion.

YELLOWHEADED SPRUCE SAWFLY *Pikonema alaskensis* (Roh.)

The yellowheaded spruce sawfly continues to be the major defoliator of white and Colorado spruce plantings in urban centers and in shelterbelts and of regeneration white spruce at many locations.

In **Alberta,** moderate-to-severe defoliation of spruce ornamentals continued to be a problem in the following urban centers: Edmonton, Red Deer, Calgary, Medicine Hat, Lethbridge, and Grande Prairie. Varying degrees of defoliation were reported on ornamental and shelterbelt spruce in and near Peace River, near Gunn and Barrhead, Westlock, Falher, Nampa, and Kinuso. Severe defoliation of planted white spruce occurred in the Waterton Lakes National Park townsite area and on spruce regeneration at scattered locations along the Cameron Lake and Red Rock Canyon roads. Light and moderate defoliation was evident on spruce regeneration along Highways 1 and 1-A in Banff National Park and along Highway 93 between Athabasca Falls and Jasper townsite in Jasper National Park.

In **Saskatchewan,** scattered pockets of light and moderate defoliation were observed on white spruce regeneration along the Kingsmere Road and near Namekus Lake in Prince Albert National Park. Similar injury was noted on ornamental spruce plantings and in some shelterbelts around Shellbrook and Melfort, in Saskatoon, Lloydminster, the Battlefords, Swift Current, and Moose Jaw.

In the **Northwest Territories,** light defoliation of white spruce was observed along Highway 5, in Wood Buffalo National Park near Pine Lake, in the vicinity of Enterprise, and near Kakisa Lake.

JACK PINE BUDWORM *Choristoneura pinus* Free.

In **Alberta,** populations of the jack pine budworm caused light defoliation in jack pine stands in the Tawatinaw-Clyde area. There was no change in the size of the infestation (70 ha) in 1989 from that reported in 1987 and 1988.

In **Saskatchewan,** endemic populations were reported in some areas of the Nisbet, Fort a la Corne, and Torch River provincial forests. No new outbreaks were reported in the province.

In **Manitoba,** the jackpine budworm was not detected in the province for the second consectutive year. Previous outbreaks spanned a period of six years, from 1982 to 1987. Pheromone traps were placed at 12 locations throughout the range of jack pine budworm in Manitoba by the Forestry Branch of the Manitoba Department of Natural Resources (MNR) and indicate a small increase in male moth captures in 1989 compared to 1988 captures. This may signal the start of a new outbreak. Foliage samples were also collected by MNR to assess defoliation, egg mass, and staminate bud production, but results are not available at this time.

DUTCH ELM DISEASE
Ceratocystis ulmi (Buis.) C. Moreau

In **Alberta,** detection surveys for incidence of Dutch elm disease (DED) were conducted in southern Alberta by Alberta Agriculture personnel from the Alberta Special Crops and Horticultural Research Centre in Brooks. Pheromone baited traps and elm trap logs were set out at 27 locations and monitored monthly. No evidence of DED or its insect vectors was found in 1989[1].

In **Saskatchewan,** ground surveys were conducted for the incidence of DED and its bark beetle vectors by Saskatchewan Parks, Recreation and Culture with continuing cooperation from Agriculture Canada's Prairie Farm Rehabilitation Administration (PFRA) and city and town parks departments. Endemic populations of the native elm bark beetle *(Hylurgopinus rufipes* Eichh.) have been identified in native elm stands at several locations in the province. Three adults of the smaller Europeon elm bark beetle *(Scolytus multistriatus* Marsh.) were found in pheromone baited traps in Regina in 1989, but no infected elm trees were evident[2].

In **Manitoba,** DED surveys were conducted primarily by the Manitoba Department of Natural Resources in 1989. Dutch elm disease infections continued to increase in native elm stands along some of southern Manitoba's river systems, especially along the Seine, Red, and Assiniboine. Smaller rivers and creeks also had DED infected elms. Along the Souris River in southwestern Manitoba, DED infected elms increased and have since spread southward into North Dakota. Diseased elm trees in native stands are generally ignored due to the impracticality and high cost of controlling infections in these areas. Dutch elm disease infected trees were detected in the following urban centers: Winnipeg, Brandon, Portage la Prairie, Morden, Dauphin, Selkirk, Steinbach, and Winkler. Many smaller eastern and central Manitoba communities experienced an increase in diseased trees in 1989. Along the Assiniboine River near St. Lazare, DED-infected trees were detected approximately 4 km north of those reported in 1988. During the 1989 summer surveys, approximately 12 000 elm trees were examined in and around urban and rural municipalities. A total of 822 trees were confirmed with DED and 11 200 were classified as hazards; many of these had died as a result of DED. In the cities of Winnipeg and Brandon, less than 2% of the elms were infected with DED. A total of 10 868 elm trees are scheduled for removal in the city of Winnipeg alone. The increased levels of DED-infected elms noted in southern Manitoba in 1989 are believed to have resulted from increased stress on the trees due to severe drought conditions 1987 and 1988[3].

In Riding Mountain National Park, DED was responsible for some mortality in native elm stands along the eastern escarpment of the park.

PLANTATION PESTS

A number of genetic experimental and other high-value conifer plantations were surveyed for insect, disease, and other damage agents in Manitoba, Saskatchewan, and Alberta in 1989. In **Manitoba,** the Department of Renewable Resources (MNR) examined over 7500 trees in 43 renewed (6- to 50-year-old) forests distributed in the southeastern and western regions of the province[4]. These included stands of red, jack, and Scots pines and white spruce. Some mortality and stem defects of the red pine were reported, attributed in part to branch and stem cankers and tip die-back, but causal agents were not readily identified. In the jack pine plantations, west-

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[1] Personal communication from A. Tellier, Entomolgy Section, Alberta Special Crops and Horticulture Research Centre, Brooks, Alberta.
[2] Personal communication from M. Pandila, Forester, Saskatchewan Department of Parks, Recreation and Culture, Prince Albert, Saskatchewan.
[3] Personal communication from Keith Knowles, Forest Protection, Manitoba Department of Natural Resources, Winnipeg, Manitoba.
[4] Unpublished report on forest pest conditions in Manitoba, 1989. Prepared by Manitoba Natural Resources for the 17th annual Forest Pest Control Forum Meeting, November, 1989.

ern gall rust *(Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka), Warren rootcollar weevil *(Hylobius warreni* Wood), pine tortoise scale *(Toumeyella parvicornis* (Ckll.)), and J-root condition were the important damage agents identified. The J-root condition resulted from machine planting, and trees exhibiting this condition were often leaning and had weakened supporting structures. Other common damage resulted from snow, hail, snowshoe hare *(Lepus americanus* Erxleben), sapsucker *(Sphyrapicus varius* (L.)), and the lodgepole terminal weevil *(Pissodes terminalis* Hopping). The white pine weevil *(Pissodes strobi* (Peck)) and snowshoe hare were the most damaging agents in white spruce.

In the Grand Beach area of Manitoba, where Scots pine was planted in 1971, the pine rootcollar weevil *(Hylobius radicis* Buch.) has caused severe tree mortality that has gradually accumulated to 15-43% in four different plantation sites.

Monitoring by Forestry Canada and MNR in Manitoba (1988) was undertaken in jack pine genetic improvement plantations established in 1971 and 1974 for screening of western gall rust infection and resistance. The plantations include 216 families and over 6400 trees. Percentage infection by family varied from 0 to 79.2%, suggesting considerable variability exists in resistance to western gall rust among jack pine populations. A similar survey was conducted (1989) in **Saskatchewan** jack pine plantations represented by 216 families and about 10 000 trees, but data analyses are still incomplete.

In **Alberta,** genetically selected conifers, mostly less than 10 years old in nine plantations and distributed from southwestern to northern Alberta, were monitored in 1989. The species represented were white spruce, jack, Scots, and lodgepole pines, and eastern and Siberian larches. In the white spruce plantations, white pine weevil contributed up to 6% (average 3.8%) incidence of top-kill and was present in five of the plantations, while yellowheaded spruce sawfly *(Pikonema alaskensis* (Roh.)) caused light defoliation of 10.2% of trees in one plantation, and Armillaria root rot *(Armillaria ostoyae* (Romag.) Herink) killed 2.0-2.4% of trees in two plantations. In one plantation, the spruce needle rust *(Chrysomyxa ledicola* Lagh.) infected 84% of the spruce seedlings.

The main damaging agents of larch included aphids, probably *Adelges* sp., that infested up to 100% of seedlings in two sites. Grass competition contributed to some decline where seedlings were less than 6 years old.

The most serious damage on the pine hosts included Warren rootcollar weevil (5-8%), western gall rust (<5%), mouse girdling (up to 18%), northern pitch twig moth *(Petrova albicapitana* (Bsk.)) (5.8-12.5%), and variable injury caused by winter or late-spring frosts.

TREE PEST EXTENSION HIGHLIGHTS 1989

The Tree Pest Extension Unit functions within the Forest Insect and Disease Survey, Northern Forestry Centre, responded to a total of 1583 inquiries during the 1989 season. All tree and plant inquiries were answered either by telephone, correspondence, on-site inspections, or at NoFC if specimens were brought into the laboratory by clients for assessment by FIDS personnel.

On coniferous species, the major insect pests were spider mites, yellow-headed spruce sawfly, white pine weevil, spruce gall aphids, spruce budworm, several open-feeding aphid species, and a clearwing moth.

On deciduous species, the major insect pests were the forest tent caterpillar, western ash bark beetles, birch leaf-mining sawflies, poplar blotch miners, scale insects, leaf beetles, and aphids.

Infectious disease problems continued to be of some concern in many areas, and the more common concerns were Septoria canker, Cytospora canker, black knot and shot hole of cherry, wetwood of elm and birch, fire blight, silver leaf, stem and branch rusts, and needle casts of pine and spruce.

Noninfectious problems, such as misuse and abuse of chemicals, continued to increase over previous seasons, including excess chloride injury. Frost, winter injury, and transplant shock were also considered major concerns.

The majority of the previously mentioned problems are listed in the noteworthy insects, diseases, and other damage agents listing.

ACID RAIN MONITORING

The Acid Rain National Early Warning System (ARNEWS) was established in 1984 to detect early signs of acid rain damage to forests. There were 12 permanent sampling plots established in the North-

west Region: 5 in Alberta, 3 in Saskatchewan, and 4 in Manitoba. These are part of a nationwide network of permanent plots set up to detect and monitor changes in soil, minor vegetation, and tree growth. All ARNEWS plots were examined twice in 1989, once in June and again in late August or in early September, and were monitored for insect, disease, and physiological damage. All basic plot data previously were completed and forwarded to the Petawawa National Forestry Institute for computer input and were published in a report. No injury attributable to acid rain symptoms was detected in any of the plots in 1989. The Suwannee River acid rain plot (Plot No. 804) in Manitoba was destroyed by fire in 1989.

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APPENDIX 1

NOTEWORTHY INSECTS, DISEASES, AND OTHER DAMAGE AGENTS

Insect, disease, or damage agent	Host	Location	Remarks
Airborne pollutants	Deciduous tree species	Alberta	Symptoms of airborne pollutant damage near Fort McMurray near the oil sands plant and in the Grande Cache area.
Aphids, open-feeding	Most species	Alberta NWT	Common on coniferous and deciduous hosts in most areas surveyed.
American aspen beetle *Gonioctena americana* (Schaeff.)	Aspen Willow	Alberta Manitoba NWT	Light-to-moderate damage in the Northwest Angle and Duck Mountain provincial parks, in Riding Mountain and Waterton Lakes national parks, and near Kakisa Lake, NWT.
Armillaria root rot *Armillaria ostoyae* (Romag.) Herink	Many hosts	Alberta Saskatchewan Manitoba NWT	Various degrees of infection causing mortality in plantations and in natural regeneration. Some mortality noted between Hay River and Fort Smith, NWT.
Aspen twoleaf tier *Enargia decolor* (Wlk.)	Aspen	Manitoba	Light defoliation in the Nelson House region.
Aspen and poplar leaf and twig blight *Venturia macularis* (Fr.) E. Müller & Arx *Venturia populina* (Vuill.) F.	Aspen Poplar	Alberta Saskatchewan	Frequently noted on regeneration in forested areas.
Aspen webworm *Tetralopha aplastella* (Hulst.)	Aspen Poplar	Saskatchewan	Common associate with forest tent caterpillar; caused scattered light-to-moderate defoliation in east-central Saskatchewan.
Atropellis canker of pine *Atropellis piniphila* (Weir) Lohman & Cash	Pine	Alberta Saskatchewan	Occurs throughout most of the range of lodgepole pine in Alberta, including the Cypress Hills.
Bear damage	Pine	British Columbia	Notable tree mortality along Highway 93 in Kootenay National Park.

Noteworthy insects, diseases, and other damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Birch leaf miners *Fenusa pusilla* (Lep.) *Profenusa thomsoni* (Konow)	Birch species	Alberta Saskatchewan	Light-to-moderate leaf mining damage to ornamental birch in most urban centers; moderate and severe mining in native stands (mostly by *P. thomsoni)* in Alberta and in Meadow Lake Provincial Park in Saskatchewan.
Blowdown	Pine Spruce	Alberta Manitoba	Some scattered white spruce blowdown in Peace River and Slave Lake forests; lodgepole pine and white spruce in Jasper National Park; and black spruce in two areas of Manitoba.
Blackknot of cherry *Apiosporina morbosa* (Schw.) Arx	Choke cherry Pin cherry May Day	Alberta	Common on native choke cherry and pin cherry and on May Day trees in central and southern areas.
Blue spruce sawfly *Cephalcia fascipennis* (Cress.)	Spruce	Alberta	Several collections from the Edmonton area and a nursery near Innisfail.
Chemical injury	Most conifers	Alberta	Improper application of herbicides, pesticides, and soil sterilants is continuing to be an ever-increasing problem in many areas.
Clearwing moth *Synanthedon* sp.	Spruce Pine	Alberta Saskatchewan	Stem and branch mortality occurring in major urban centers in Alberta. Some injury noted on mature spruce in Saskatchewan.
Comandra blister rust *Cronartium comandrae* Pk.	Pine	Manitoba	Light infections found in plantation surveys in the Stead and Sandilands areas.
Cone maggot *Strobilomyia* sp.	Tamarack	Manitoba	Severe damage to cones and seeds in the Nourse area.

Continued on next page

Noteworthy insects, diseases, and other damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Conifer seedling damage	Spruce	Alberta	Low incidence of 1 + 0 bare-root seedlings at Pine Ridge Forest Nursery girdled below ground level, probably by strawberry root weevil *(Otiorhynchus ovatus* L.).
Cottonwood leafmining beetle *Zeugophora abnormis* LeConte	Poplar	NWT	Light damage on young balsam poplar near Kakisa Lake.
Dwarf mistletoe *Arceuthobium pusillum* Pk.	Spruce	Manitoba	Light infections noted on black spruce in Manitoba.
Aspen leaf-roller *Pseudexentera oregonana* Wlsm.	Aspen	Alberta Saskatchewan Manitoba	Light-to-moderate leaf rolling in many areas of southern Alberta. Moderate-to-severe injury across central Saskatchewan and near Poplarfield and Ashern in Manitoba. Associated with forest tent caterpillar.
Eastern black-headed budworm *Acleris variana* (Fern.)	Spruce	Manitoba	Light defoliation in Riding Mountain National Park.
Eastern pine shoot borer *Eucosma gloriola* Heinr.	Pine	Manitoba	Light shoot damage in plantations in southeastern Manitoba.
North American fruit lecanium *Parthenolecanium corni* (Bouché)	Manitoba maple	Saskatchewan	Light-to-moderate infestations in the Prince Albert area.
Excessive needle drop	Pine Spruce	Alberta	Extensive natural pruning reported in many areas in the province, probably accentuated as the result of a severe frost that occurred in early fall.

Noteworthy insects, diseases, and other damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Fall cankerworm *Alsophila pometaria* (Harr.)	Elm Green ash Manitoba maple	Alberta Saskatchewan Manitoba	Light-to-severe defoliation in most urban centers in Saskatchewan, Manitoba, and southern Alberta.
Fir coneworm *Dioryctria abietivorella* (Grt.)	Pine Spruce	Alberta	Light occurrence in central Alberta; common in Pine Ridge Forest Nursery.
False tinder conk *Phellinus tremulae* (Bond.) Bond. & Boriss.	Aspen	Manitoba	Light infection noted in plantations.
Fire blight *Erwinia amylovora* (Burr.) Winsl. et al.	Apple Mountain-ash	Alberta Saskatchewan Manitoba	Scattered light infections throughout the region.
Frost injury (late spring)	Spruce	Alberta Saskatchewan	Light-to-moderate bud and shoot damage in several plantations in both provinces.
Grieving woodling *Egira dolosa* (Grt.)	Aspen	Manitoba	Light-to-moderate defoliation near Shergrove.
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) Miller	Aspen Poplar	Alberta Saskatchewan Manitoba	Infections are common throughout the central aspen forests.
Leaf-folding sawfly *Phyllocolpa* nr. *agama* (Rohwer)	Poplar	Alberta	Generally light damage on poplar regeneration.
Leaf rust on aspen *Melampsora* sp.	Aspen	Alberta	Moderate-to-severe infections in aspen stands in central and northern Alberta.
Lodgepole needleminer *Coleotechnites starki* (Freeman)	Pine	Alberta	Low population levels evident in Banff National Park in the Saskatchewan Crossing and Weeping Wall area and near Mt. Norquay and Banff.

Continued on next page

Noteworthy insects, diseases, and other damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Lodgepole terminal weevil *Pissodes terminalis* Hopping	Pine	Alberta Saskatchewan	Low populations in lodgepole pine in Alberta foothills. Incidence as high as 20% in jack pine plantations in central Saskatchewan.
Northern pitch twig moth *Petrova albicapitana* (Bsk.)	Pine	Alberta Manitoba NWT	Light damage to young stands and plantations in Alberta and Manitoba and in natural regeneration in the NWT.
Northern spruce borer *Tetropium parvulum* Casey	Spruce	Alberta	Caused wormhole damage and lumber degrade to white spruce timber in northern Alberta.
Pear sawfly *Caliroa cerasi* (L.)	Cotoneaster Pin cherry Mountain-ash	Alberta	Skeletonizing was common in most urban centers in the province.
Pine false webworm *Acantholyda erythrocephala* (L.)	Pine	Alberta	Found defoliating Scots pine in Edmonton. New regional record.
Pine needle scale *Chionaspis pinifoliae* (Fitch)	Pine Spruce	Alberta Saskatchewan Manitoba	Light infestations on ornamentals and shelterbelt trees in central Alberta. Moderate and severe damage to spruce plantings in Maidstone and in the Caronport area in Saskatchewan. Light damage to jack pine in Spruce Woods Provincial Forest and in the Sandilands, Manitoba.
Pine tortoise scale *Toumeyella parvicornis* (Ckll.)	Pine	Manitoba	Moderate-to-severe damage in young pine plantations in the Sandilands area.
Poplar gall-forming mite *Aceria* nr. *dispar* (Nalepa)	Aspen	Alberta	Moderate-to-severe infestations in the Stettler-Castor area of east-central Alberta.

Noteworthy insects, diseases, and other damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Poplar serpentine leafminer *Phyllocnistis populiella* Chambers	Aspen	NWT	Caused extensive leaf mining damage between Trout River and Fort Simpson and in the Fort Liard and Nahanni Butte areas. Light-to-moderate incidence occurred near Fort Providence, Enterprise, and Fort Smith. A marked increase in defoliation was observed from Trout River westward to the Fort Simpson, Nahanni Butte, and Fort Liard areas.
Porcupine damage	Conifers	British Columbia Alberta	Scattered indivdual tree mortality in shelterbelt and ornamental plantings in central and southern Alberta; scattered lodgepole pine mortality in Yoho National Park.
Powderpost beetle *Ptilinus lobatus* Csy.	Spruce	Alberta	This is the first known record of this anobiid beetle species causing structural damage to spruce timbers in an apparently unheated barn.
Powdery mildew *Uncinula salicis* (DC. ex Mérat) Wint.	Aspen	Alberta Manitoba	Light-to-moderate incidence scattered throughout the aspen parkland zone in Alberta and on saplings in Duck Mountain Provincial Park in Manitoba.
Red belt	Alpine fir	Alberta	Notable injury evident along west-facing slopes of the Endless Chain Mountain Range in Jasper National Park.
Rusty tussock moth *Orgyia antiqua* (Linnaeus)	Pine	Alberta	Severe defoliation to caragana in Grande Prairie.

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Noteworthy insects, diseases, and other damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Salt damage	Pine	Alberta	Road salts used for de-icing caused notable tree mortality in many areas of the province.
Spruce beetle *Dendroctonus rufipennis* (Kby.)	Spruce	Alberta	Severe attack to a single tree found in Sir Winston Churchill Provincial Park. Endemic populations in central, western, and northwestern Alberta.
Spruce bud midge *Rhabdophaga swainei* Felt	Spruce	Alberta	Terminal bud damage was common in plantations and in natural regeneration in central Alberta.
Spruce gall aphid *Adelges cooleyi* (Gill.)	Spruce	Alberta Saskatchewan Manitoba NWT	Light-to-moderate throughout the region.
Spruce needle rust *Chrysomyxa ledicola* Lagh.	Spruce	British Columbia Alberta Saskatchewan NWT	Moderate-to-severe infections in Kootenay National Park and along Highway 93 in Banff National Park; light infections along Highway 35 north of Paddle Prairie and in Grande Prairie, Edson, and Whitecourt forests. Decreased severity was noted in areas north of Paddle Prairie along Highway 35. Scattered light infections were common across central Saskatchewan; moderate-to-severe near Little Fishing Lake. A light infection was noted near Kakisa Lake, NWT.
Spruce spider mite *Oligonychus ununguis* (Jac.)	Spruce	Alberta Saskatchewan Manitoba	Generally light throughout the region.

Noteworthy insects, diseases, and other damage agents, continued

Insect, disease, or damage agent	Host	Location	Remarks
Squirrel damage	Pine	Alberta Saskatchewan Manitoba NWT	Light branch flagging injury noted at several locations, resulting from cone clipping.
Western ash bark beetle *Hylesinus californicus* (Swaine)	Mountain-ash	Alberta Saskatchewan	High damage incidence noted in southern Alberta. Low populations noted in Saskatchewan.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Pine	Alberta Saskatchewan Manitoba NWT	Common in pine regeneration and plantations.
White pine weevil *Pissodes strobi* (Peck)	Pine Spruce	Alberta Saskatchewan Manitoba	Low-to-medium incidence on young spruce in Riding Mountain and Kootenay national parks and in spruce and pine plantations in western Manitoba and central and northern Alberta. Light damage was common in central Saskatchewan. Severe injury was evident in some private nurseries in Alberta.
Winter drying	Most species	Alberta Manitoba	Severe bud and foliage injury was common in many areas in Alberta. Some injury to red pine was reported near Falcon Lake in Manitoba.
Yellow witches' broom *Chrysomyxa arctostaphyli* Diet.	Spruce	Alberta Saskatchewan Manitoba NWT	Common disease in many mature and semimature stands.